variations occur because of changes in atmospheric conditions, including rain rate, humidity, barometric pressure, and temperature.[19] All of these factors apply to some degree everywhere in the U.S.

Figures 1A and 1B show data for three line-of-sight paths. The short paths (less than 20 kilometers) shown in Figure 1A clearly show a strong Rician (fixed path loss) component, with minimal variance about the mean.[20] The cumulative distribution function (CDF) of signal strengths is almost constant within a range of 2–3 dB, over the 10%–99% time probabilities. Figure 1B is also a line-of-sight path, but it is much longer at over 100 kilometers, and the amplitudes span a wide range from -60 to -75 dBm (15 dB) over the same time probability range.

Figure 1C shows data for three non-LOS paths of significant length (greater than 60 kilometers) showing signal level variations ranging from 6–9 dB for the shorter paths (KPIX-DT and KKPX-DT) to over 12 dB for the longest path (KNTV-DT).

Of particular interest is the variation in signal level less than 10% the time. Recall that F(50,90) statistical reliability is stated in the FCC planning factors for DTV. A temporal reliability of 90% can represent no DTV picture for the viewer 36.5 days a year (10% of the time). Because a DTV signal below threshold results in no picture at all, allowing for just 90% time reliability (*i.e.*, up to five weeks of outage) seems not to be in the consumer's best interest. An increase in temporal reliability to 99% (or better) seems prudent until there is greater experience with consumer reception of DTV signals, although this represents still 3.65 days a year without a usable signal.

At VHF high band Channel 12, signal strength variation with time about the median was found to be about 3.5 dB for 90% probability. Thus, 90% time reception would be expected only if the measured median signal strength is made 3.5 dB stronger than the DTV threshold. This is the value that must be exceeded during short-term cluster measurements. Taking the 99% probability level increases the required signal level by 4.7 dB. At UHF Channel 41, 90% probability of reception requires a signal 4.9 dB above the DTV threshold, while 99% probability requires a signal of about17.5 dB above threshold. The measured 90% time values agree reasonably well with the chart shown on page 5.

The most striking feature of Figure 1 is the pronounced fading during a mild storm in the San Francisco Bay Area, which decreased UHF signal levels by about 15 dB during portions of May 18 and 19. Rain rates at the receive site measured as high as 15.5 mm/hr, but were typically about one-third of that value.

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[19] R.E. Gray, "The Refractive Index of the Atmosphere as a Factor in Tropospheric Propagation Far Beyond the Horizon," Institute of Radio Engineers National Convention Record, 1957.

[20] The parameter describing the power ratio of the fixed and fluctuating components is called the Rician K-factor, which is very high for these short line-of-sight paths. Field measurement of the Rician K-factor may be a useful indicator of reliability with time of the DTV signal.

3. Factors Other Than Signal Strength that Affect Reception

Four major factors that impact the ability to receive a DTV signal are:[21]

- carrier to noise ratio
- multipath
- noise interference (especially impulsive noise)
- interference from other signals

All of the technical information sought by the Commission in this NOI pertains to the impact of practical or empirical implementations of DTV technology on one or more of these factors. Note that signal strength is not one of the four major factors listed above.

Adequate signal strength is necessary but is not, by itself, sufficient for DTV reception. Summary data for twelve DTV field measurement campaigns through 1999 have been reported.[22] These data show that at UHF, 12% of locations having the requisite DTV signal strength at the location of an outdoor antenna failed to produce a usable picture. This percentage increased to 18% for sites that were obstructed from the transmitting antenna. For indoor antennas, the ATSC system failed to produce a picture at 26% of the locations having adequate signal strength. From these data, it might be expected that one-eighth to one-quarter of viewers having adequate signal strength will be unable to receive a DTV picture. Future DTV receivers will undoubtedly be able to produce a DTV picture in some locations where the earlier receivers could not, but these results illustrate that there has been a significant failure rate where consumers cannot receive DTV even though a theoretically-adequate signal level is present.

Static Multipath

The presence of multipath ("echoes") in the DTV signal, which can be of fixed delay (typically due to reflections from terrain and large man-made features such as buildings), causes the so-called "equalizer" circuitry in the DTV receiver to operate. The equalizer, in attempting to create an idealized amplitude and phase response to compensate for the non-ideal transmission channel, will increase the system's noise at the frequencies of compensation. The increased noise due to equalizer action is commonly called "white noise enhancement" and is a function of how much correction the various equalizer taps must apply (*i.e.*, how "hard" the equalizer is working). The white noise enhancement, in effect, increases the necessary signal threshold for detection of the DTV signal.

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21 James A. Kutzner, "The Challenges of Indoor DTV Reception," Proc. NAB Broadcast Engineering Conference, 2001.

22 Gary Sgrignoli, "DTV Field Test Methodology and Results and Their Effect on VSB Receiver Design," IEEE Transactions on Consumer Electronics, Vol. 45, No. 3, August 1999.

Sgrignoli[23] published the relationship between total equalizer tap energy relative to the main tap and white noise enhancement. Over the tap energy range of -20 to 0 dB, the white noise enhancement ranges from 0 to 3 dB. At a "good" receiver location (having little multipath), the tap energy might be about -10 dB, corresponding to a white noise penalty of less than 0.5 dB. However, at a poor location, the white noise penalty may exceed 2 dB. Therefore, field measurements should include collection of white noise enhancement values, or equivalently, tap energy data. Such data can be obtained from professional DTV demodulators, which are available from several sources.[24] The resulting white noise enhancement would then be subtracted from the measured field strength.

Dynamic Multipath

There remain some types of channel impairments (*e.g.*, impulse noise and dynamic multipath) and co- and adjacent-channel (and perhaps other types of) DTV interference that even the latest DTV receivers cannot handle. For example, so-called "third generation" DTV receivers, which (along with fourth-generation receivers) are commonly available today, have difficulty handling single dynamic echoes greater than 40% of the amplitude of the main component.[25] Such dynamic multipath can occur, for example, when a DTV signal is reflected off an airplane (which leads to so-called "airplane flutter" in NTSC systems). Even poorer performance results when multiple dynamic echoes are present, as when cars are moving on the street or people are walking in the vicinity of an indoor antenna.[26]

Man-Made Noise

With regard to DTV receiver performance in the presence of impulse-type noise, it is well known that such noise is the likely cause of many reported failures to receive DTV signals, even though adequate signal strength is present.[27] Man-made impulse noise includes sources such as power line arcing, industrial machinery, automotive ignition systems, appliances having electric motors (*e.g.*, vacuums, dishwashers, hair dryers, etc.), devices having switching power supplies (*e.g.*, computers, and many modern electronic devices), and microwave ovens. A suspected flaw in the DTV technical specifications (FCC Rules, Section 73.622(e)(1)) is the specified minimum usable signal level at low-band VHF channels (2–6). It has been widely reported that the specified value of 28 dBμV/m is inadequate in many

[23] Gary Sgrignoli, "DTV Field Test Methodology and Results and Their Effect on VSB Receiver Design," IEEE Trans. on Consumer Electronics, Vol. 45, No. 3, August 1999.

[24] Sources include Zenith and Z Technologies, Inc.

[25] Strolle, C.H., *et al.*, "Feasibility of Reliable 8-VSB Reception," Proc. NAB Broadcast Engineering Conference, 2000.

[26] Simon Wegerif, "The Evolution of Front Ends for Digital TV," Proc. NAB Broadcast Engineering Conference, 1999.

[27] Gary Sgrignoli and Richard Citta, "Summary of Grand Alliance VSB Transmission System Field Test," Proc. NAB Broadcast Engineering Conference, 1996.

contexts, particularly where there is man-made noise (especially impulse noise) present in the environment.

The Commission's DTV planning factors do not appear to adequately account for this significant source of man-made noise, particularly at low-band VHF frequencies (TV Channels 2–6), where the minimum required signal level is assumed to be just 25.2 dB above thermal noise.[28] Thermal (kTB) noise power is -106.2 dBm in a bandwidth of 6 MHz, and the minimum signal level required for DTV reception specified in the planning factors is -81 dBm, giving a difference of 25.2 dB for system noise, demodulation, and other factors. The system noise figure of 10 dB assumed in the FCC DTV planning factors, and the 15 dB signal-to-noise ratio required for DTV receiver operation, leave an implementation margin of just 0.2 dB.

Past studies have shown that, in rural locations, man-made noise levels are typically 20 dB above kTB, and in urban areas such noise is typically 30 dB above kTB near 54 MHz (TV Channel 2).[29] The increasing use of electrical and electronic equipment in the U.S. suggests that current noise levels could become much greater. Indeed, more recent studies[30] have found median noise levels in Boulder, Colorado, approaching 20 dB at 137 MHz, which implies a median value approaching 30 dB at 54 MHz. If 20 or 30 dB of man-made noise is added to the thermal noise floor, certainly, some viewers in urban areas will be unable to receive low-band DTV signals due to excessive man-made noise.

DTV measurements on low-band VHF channels conducted in the Washington, DC and Cleveland, Ohio, areas found a relatively high level of failures at moderate and weak signal levels, which "suggested that the planning factors adopted by the FCC to predict low VHF service are inadequate – probably attributed to increase[s] in the environmental noise threshold."[31] It has been reported that the minimum field strength at which the DTV signal is decodable at Channel 2 in an indoor environment is at least 40 dBu, compared with the specified value of 28 dBu.[32] Thus it appears that an additional margin of 12–30 dB could be required for adequate reception of low-band VHF DTV signals.

Low-band VHF stations will probably represent a small fraction of all DTV stations, but they may include large rural land areas where DBS providers have many subscribers. According to available

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[28] The FCC planning factors reflect a "system noise figure" of 10 dB at VHF frequencies, which reportedly includes 5 dB for receiver noise and 5 dB for environmental noise. This value is significantly lower than reported by Spaulding and Disney and ITU Recommendation ITU-R P.372-8 (2003). See text.

[29] A.D. Spaulding and R.T. Disney, "Man-made radio noise, part 1:estimates for business, residential, and rural areas," NTIA Office of Telecommunications Report OT 74-38, Jun. 1974.

[30] Robert J. Achatz and Roger A. Dalke, "Man-Made Noise Power Measurements at VHF and UHF Frequencies," NTIA Report No. 02-390, December 2001.

[31] Victor Tawil, MSTV, "Considerations in Using Low-VHF Channels for DTV," Proc. IEEE Broadcast Technology Symposium, 2001.

[32] Carl G. Eilers and Gary Sgrignoli, "An Analysis of DTV Propagation into and within a Room in a Domestic Environment," IEEE Broadcast Technology Symposium, 2001.

information, 1,693 of 1,761 U.S. television stations (96%) have made a DTV channel election. Of these 1,693, the vast majority (1,223 or 72%) elected a UHF channel, while 427 (25%) elected a high-band VHF channel and 43 (3%) elected a low-band VHF channel. Of the 43 stations electing a low-band channel, 28 are affiliates of the "big-four" networks, while 4 are affiliated with other networks, and 11 are non-commercial.

4. Predictive model

It appears that the predictive methodology presently used in the SHVA context (ILLR) has considerable applicability to the DTV world, but there remain improvements that might be made to properly accommodate reliable DTV reception. Some of these improvements are discussed below.

The FCC intends that DTV stations replicate their NTSC "Grade B" service areas. The Grade B F(50,50) service contours are based upon the assumption that an "acceptable" quality of service will be available at the best 50% of locations, 90% of the time.[33] Thus, to "replicate" coverage, the DTV signal also needs to produce an acceptable picture with50% situation reliability at least 90% of the time. Of course, in the case of NTSC, the difference between an acceptable picture and an unacceptable one might be an increase in the amount of snow; in DTV, the difference between an acceptable picture and an unacceptable one is no picture at all. So, the statistical parameters of the ILLR model should be set to the appropriate values. Presently, the ILLR model, as specified in OET Bulletin No. 72 for NTSC signals specifies that the time and situational variability factors are to both be set at 50%. We believe that for DTV, the appropriate factors would be 50% situation (confidence) variability[34] and 90–99% time variability, with the greater value being most prudent, at least until there is greater experience with consumer reception of DTV signals.

Factors for building penetration loss and use of an indoor antenna, as suggested elsewhere in this report could be incorporated into the ILLR model, when appropriate. A factor to account for ubiquitous antenna pointing errors is also appropriate for consumers having access to outdoor antennas.

Although a system noise figure has been assumed in the FCC planning factors for DTV receivers, that figure assumes a conjugate-impedance match between the receiver and antenna. In fact, a household antenna is rarely matched to the receiver.[35] Many of the antennas presently available for DTV have VSWR values that exceed 3:1 over much of their design bandwidth and exceed 2:1 over essentially all of

[33] Robert A. O'Conner, "Understanding Television's Grade A and Grade B Service Contours," IEEE Trans. on Broadcasting, Vol. BC-14, No. 4, December 1968.

[34] When point-to-point mode is used, as in ILLR, there are well-defined paths with fixed terminals, so there is no location variability. There is still a "confidence" or "situation" variability factor of 50% that is sometimes called "location" variability, but the proper term is "situation" probability. See George Hufford, "The ITS Irregular Terrain Model, version 1.2.2: The Algorithm" for more information.

[35] Cozad, *op cit.*

their design bandwidth. The latter figure represents an increase in the effective system noise figure of 3 dB, which could also be incorporated into the model.[36]

5. Variability Among Consumer DTV Receivers.

Consumer DTV receiver designs continue to evolve. Five receivers (four consumer and one professional model) were evaluated for sensitivity for comparison with the FCC's planning factors, as follows:

1. LG LST-4200A
2. Samsung SIR-T451
3. Motorola HDT101
4. RCA DTC100
5. Zenith DTVDEMOD-S

Receivers 1, 2, and 3 were obtained from retail vendors in May 2005. Receiver 4 is an older model, purchased in 2000. Receiver 5 is a professional ATSC demodulator, which provides detailed information concerning equalizer performance, error rate, and other parameters.

The receivers were set up at a location (Alameda, California) having favorable path characteristics for DTV reception; that is, relatively constant signal levels, and multipath components having minimal amplitude and short delay. The receivers were connected to a common antenna and attenuation was added in 1 dB steps until visible failure of DTV reception occurred. The measurements show the differences in sensitivity of the receivers under favorable field conditions. The estimated margin of error for these measurements was ±1.5 dB.

	Measured Sensitivity by Channel, dBm						
Receiver	D12	D23	D29	D43	D41	D47	D49
1	-81.9	-82.6	-84.1	-80.4	-82.8	-81.1	-81.8
2	-80.9	-80.6	-83.1	-81.4	-80.8	-81.1	-82.8
3	-78.9	-83.6	-83.1	-83.4	-83.8	-82.1	-82.8
4	-75.9	-78.6	-82.1	-77.4	-77.8	-78.1	-78.8
5	-75.9	-78.6	-79.1	-79.4	-77.8	-79.1	-79.8
Variation in sensitivity RX1–4	6 dB	5 dB	2 dB	6 dB	6 dB	4 dB	4 dB
FCC PF	-81.2	-84.2	-84.2	-84.2	-84.2	-84.2	-84.2

The above results show that consumer receivers can differ in sensitivity by 2–6 dB under favorable field conditions. Laboratory tests (apparently at one channel) showed differences on the order of 0–3.4 dB without multipath and 0–8.7 dB in the presence of static multipath.[37,38]

36 Bendov, *op cit.*

37 Charles Einolf, "DTV Receiver Performance in the Real World," Proc. NAB Broadcast Engineering Conference, 2000.

After compensating for the white noise enhancement of the equalizer (typically 0.2 dB), which was taken from Receiver 5 and assumed to apply to all of the other receivers, the sensitivities can also be compared with the FCC planning factor ("PF") values of -81.2 dBm at VHF and -84.2 dBm at UHF. Depending upon the channel involved, some receivers were up to 6.6 dB less sensitive than the planning factors specify. Considering all channels, the typical receiver was 2.6 dB less sensitive than the FCC planning factors.

6. Building Penetration Loss, Interference, and Clutter

Building penetration losses

Indoor receiving antennas, apart from having less gain than their outdoor counterparts, will typically be subject to weaker DTV signals. This is because the TV signal is attenuated as it passes through common building materials. The FCC conducted a measurement campaign, which found median building penetration losses of 30 dB at VHF and 26 dB at UHF for a number of buildings in the most "cluttered" parts of New York City.[39] In relatively less cluttered areas (boroughs outside of Manhattan), the measured building penetration losses were about 25 dB at VHF and 21 dB at UHF. Detailed information concerning the height of the receiving antenna (first floor, second floor, etc.) was not provided. A series of measurements conducted at UHF frequencies in the U.K. found building penetration losses in a six-story building of up to 16.4 dB at ground level, generally decreasing to about 2.5–4.2 dB at the sixth floor.[40] UHF frequencies tend to propagate into buildings better (that is, have less building penetration loss) than VHF frequencies because the dimensions of typical building openings (doors and windows) allow Fresnel clearance at the shorter UHF wavelengths. So, the building penetration losses at VHF television channels are expected to be greater.

The chart below, adopted from Parsons, shows a possible relationship at UHF between height in stories of the indoor receiving antenna and building penetration loss. For example, a viewer in a third-floor apartment having an indoor back-of-set antenna might be expected to experience a signal 10 dB weaker than an equivalent antenna outside the building. Note that in the United Kingdom, the ground floor is considered Floor zero, and the upper floors begin at one.

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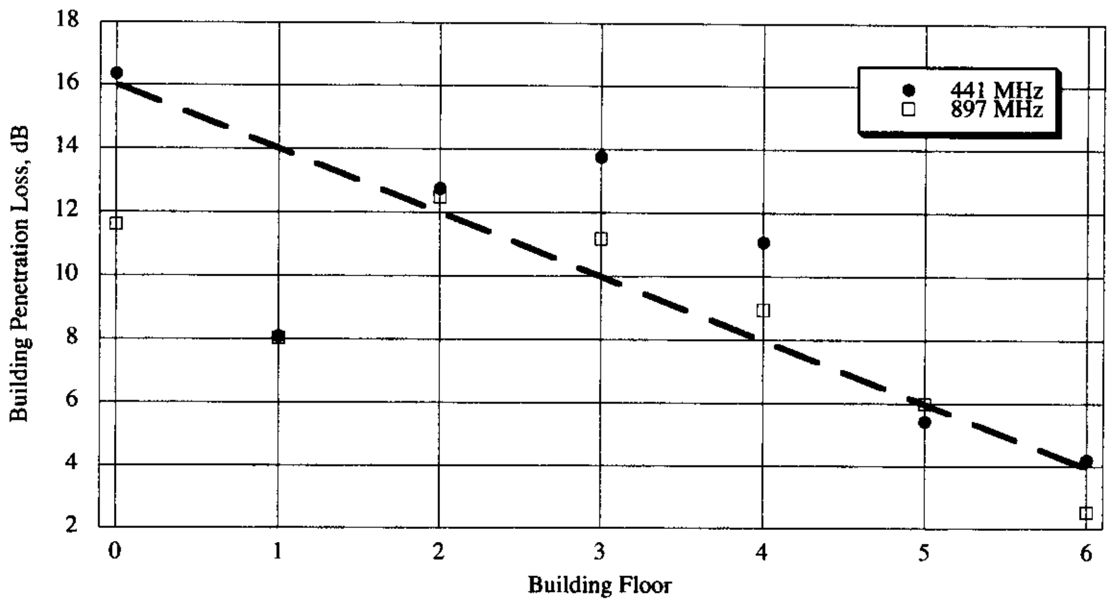
[38] Bernard Caron, *et al.*, "ATSC 8-VSB Receiver Performance Comparison," Proc. NAB Broadcast Engineering Conference, 2000.

[39] G.V. Waldo, "Report on the Analysis of Measurements: New York City UHF-TV Project," IEEE Trans. Broadcasting, Vol. BC-9, No. 2, 1963.

[40] J.D. Parsons, The Mobile Radio Propagation Channel,(West Sussex: John Wiley & Sons, 1992).



Interference from other signals

Several respected engineers have expressed concern about interference from adjacent-channel and intermodulation interference sources.[41][42] This firm is aware of several failures of DTV reception that are clearly attributable to so-called "image interference" from strong undesired signals. Image interference is not presently considered by the FCC in DTV-to-DTV station allocation. It appears, however, that there are presently insufficient data to assess typical consumer receiver performance in practical situations. This is because of the relatively small number of "full power" DTV stations presently on the air and the small installed base of consumer DTV receivers. With regard to co- and adjacent-channel interference, the existing protection ratios as documented in OET Bulletin No. 69 might be used presumptively to determine the presence of interference in both calculation and measurement. While these protection ratios are not based upon measurements of actual consumer DTV receivers, they can be expected to provide reasonable goals for DTV receiver designs.

Quantifying the circumstances under which current-generation DTV receivers cannot produce a picture when given adequate signal requires considerable data collection and time, and we are aware of no such

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[41] Oded Bendov, "Interference to DTTV Reception by First Adjacent Channels," IEEE Trans. on Broadcasting, Vol. 51, No. 1, March 2005.

[42] Charles W. Rhodes, "Interference between Television Signals Due to Intermodulation in Receiver Front-Ends," IEEE Trans. on Broadcasting, Vol. 51, No. 1, March 2005.

efforts planned or underway. The absence of this critical data should *not* be used to imply that all reception issues have been resolved.

Clutter losses

As with NTSC signals, man-made and environmental clutter also effects DTV reception. Therefore, it remains important to include realistic clutter factors in the predictive model used for DTV.

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STATE OF CALIFORNIA

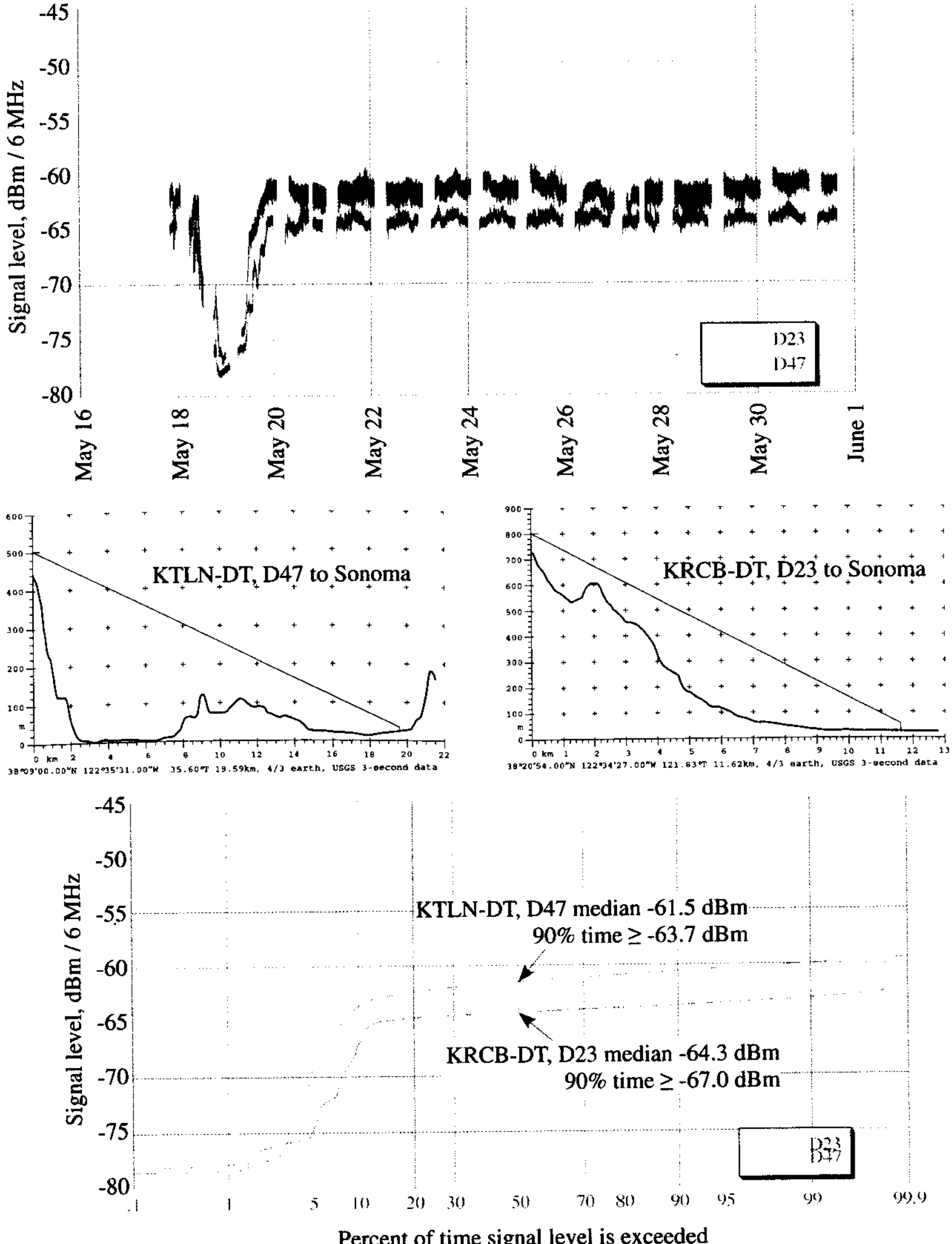
Robert D. Weller

Robert D. Weller, P.E.

June 17, 2005

EchoStar Satellite, L.L.C. • Englewood, Colorado

Measured DTV Signal Levels – Short Line-of-Sight Paths

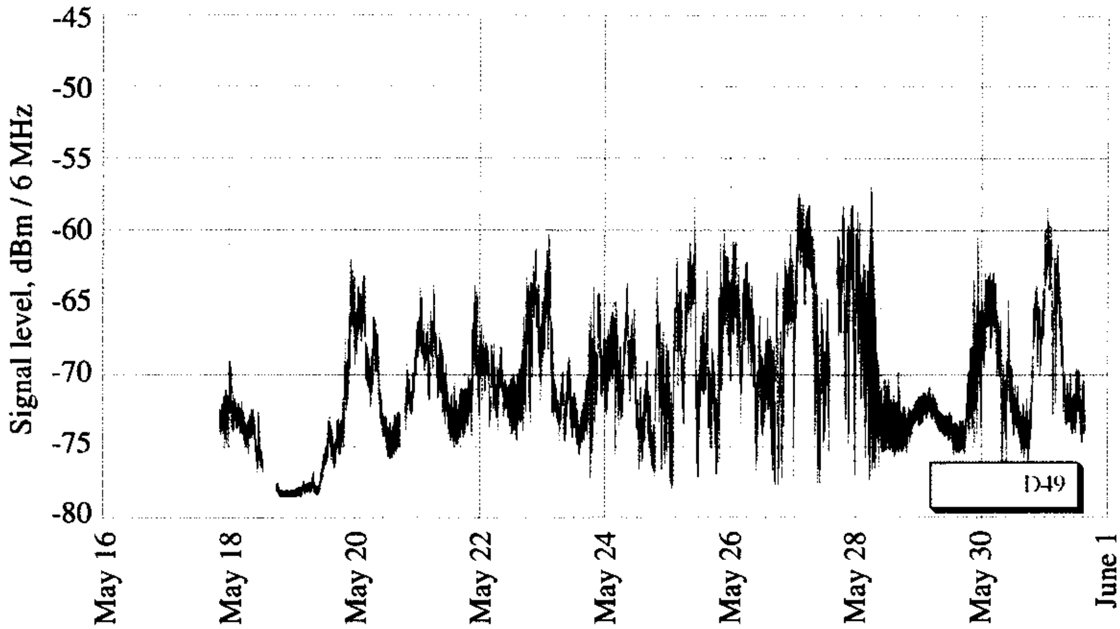


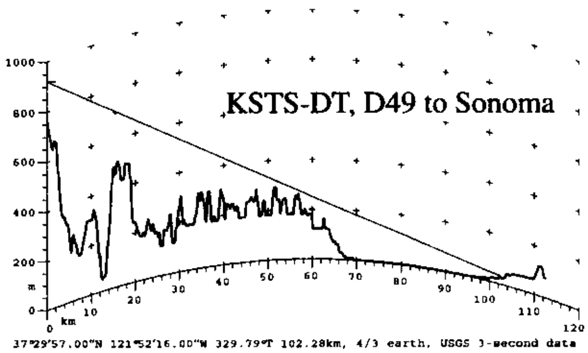
HAMMETT & EDISON, INC.
CONSULTING ENGINEERS
SAN FRANCISCO

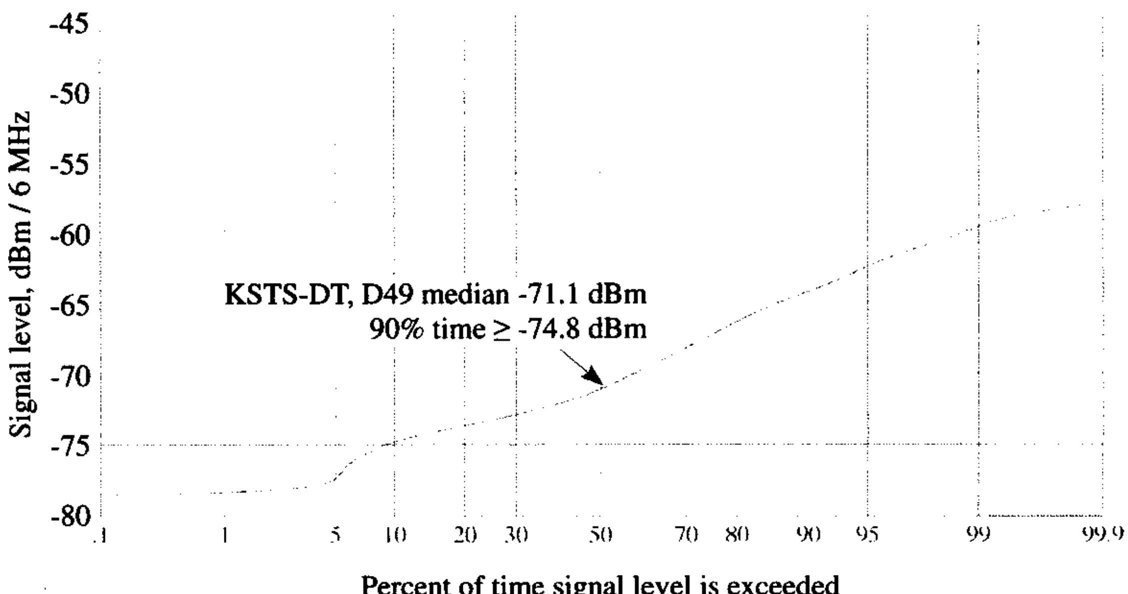
050617
Figure 1A

EchoStar EchoStar Satellite, L.L.C. • Englewood, Colorado

Measured DTV Signal Levels – Long Line-of-Sight Path

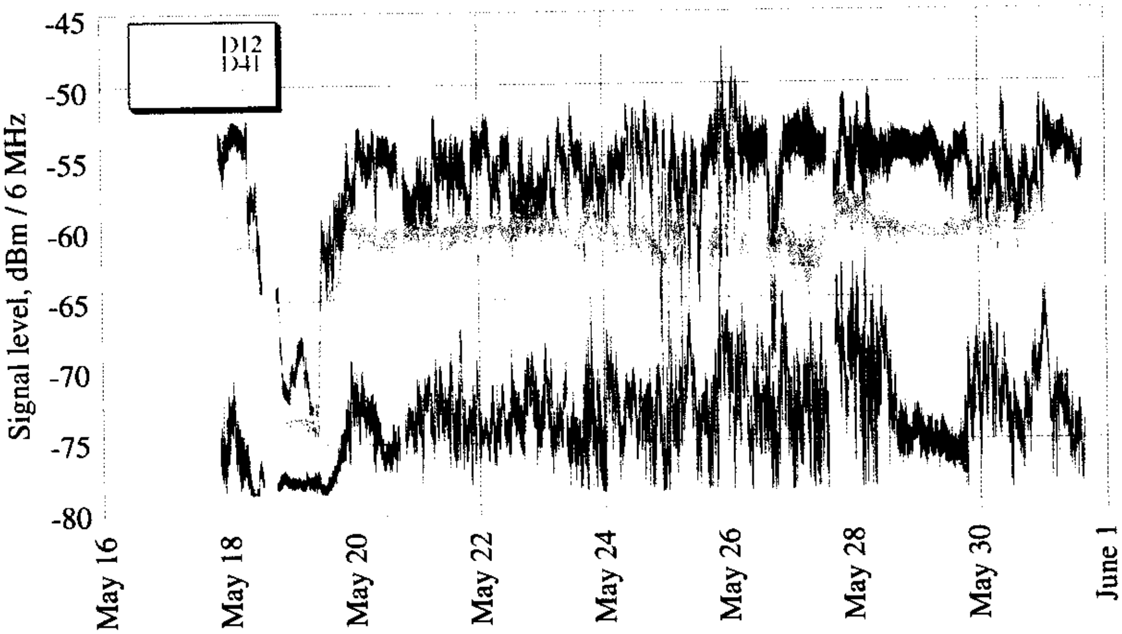


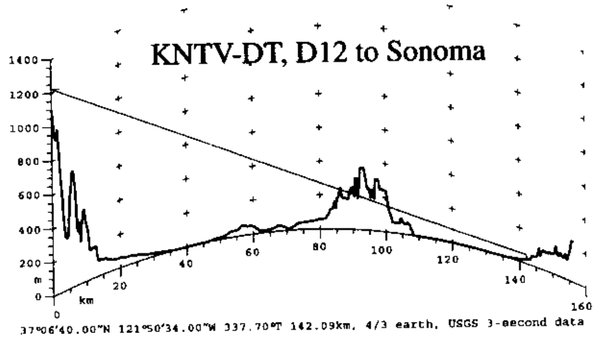


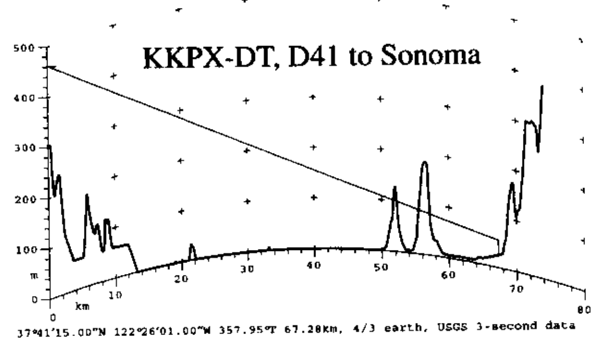


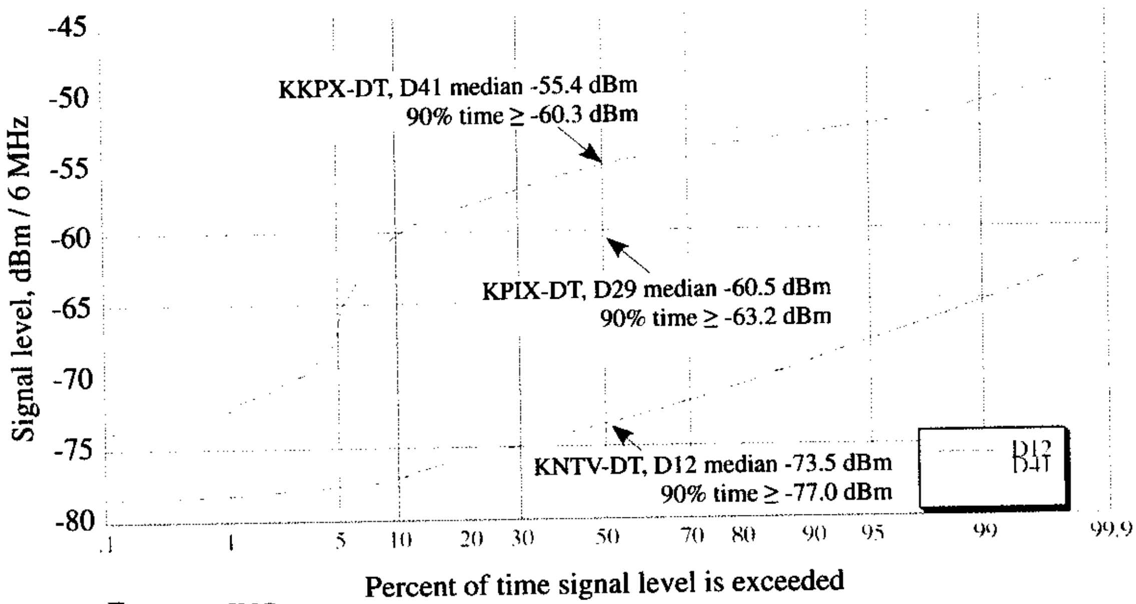
EchoStar EchoStar Satellite, L.L.C. • Englewood, Colorado

Measured DTV Signal Levels – Obstructed Paths









Before the
Federal Communications Commission
Washington, D.C. 20554

In Re Technical Standards for Determining	)	
Eligibility for Satellite-Delivered Network	)	**ET Docket No. 05-182**
Signals Pursuant to the Satellite Home	)	
Viewer Extension and Reauthorization Act	)	

COMMENTS OF THE NATIONAL ASSOCIATION OF BROADCASTERS

Marsha J. MacBride
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June 17, 2005

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EXECUTIVE SUMMARY

The philosophy behind the latest revision of the original SHVA – the Satellite Home Viewer Extension and Reauthorization Act of 2004 ("SHVERA") – is captured in Section 204, which is entitled "Replacement of Distant Signals with Local Signals." That provision reiterates Congress' strong preference for local over distant signals in a variety of ways, including through implementation of the "if local, no distant" principle.

That simple – and sensible – policy is at the heart of SHVERA. Because local-to-local service is the *desirable* way to deliver network affiliates to satellite subscribers, and because distant network station signals are at best a *necessary evil*, the SHVERA pushes the DBS industry towards the former and away from the latter.

While recognizing the overwhelming desirability of local-to-local over distant network signals, Congress also decided to create a narrowly-limited new right to transmit distant signals based on the unavailability of an over-the-air *digital* signal. 47 U.S.C. § 339(a)(2)(D)(i)(III). This new method of qualifying subscribers to receive distant signals will not go into effect until April 30, 2006, and even then it will apply only to a limited number of stations in the top 100 markets. (Other stations will be subject to this new rule in 2007 or later.)

While the Senate Commerce Committee approved a bill in 2004 that would have enabled DBS companies to use a digital *predictive* model to sign up new subscribers for distant digital signals, Congress as a whole ultimately rejected that approach. As enacted, therefore, the SHVERA allows a satellite carrier to sign up a subscriber claiming unavailability of an over-the-air digital signal *only* based on the results of an actual field measurement. 47 U.S.C. §§ 339(a)(2)(D)(i)(III), 339 (a)(2)(D)(vi). It would take an act of Congress for a DBS firm to be able to rely on a digital predictive model to sign up a subscriber for a distant digital signal.

The Commission's current Inquiry concerns the extent to which the DBS companies will be authorized to use the SHVERA compulsory license to retransmit the HD signals of New York or Los Angeles stations to customers in Glendive, Montana, Presque Isle, Maine, Dayton, Ohio and more than 200 other markets across the United States. In preparing its recommendations, the Commission should ensure that no DBS company can use the distant digital compulsory license as an inexpensive, large-scale *substitute* for digital local-to-local. Broadcasters, Congress, and the Commission all remember well what it was like in the 1990's when the DBS industry massively abused the *analog* distant-signal compulsory license, illegally "hooking" millions of ineligible customers on distant signals. The Commission's recommendations should be carefully designed to ensure that this sordid history does not repeat itself.

The following is a brief summary of NAB's comments in response to the specific questions that the Commission has asked about technical issues:

- **Type of antenna**: The Commission should continue to assume use of a properly-oriented directional rooftop antenna with substantial gain. Antennas of that kind, which fully satisfy (or exceed) the Commission's DTV planning factors, are readily available at low cost.

It would be difficult to overstate the unfairness of assuming that viewers will use only indoor (or low-quality outdoor) antennas. *Satellite* antennas (dishes) do not work when they are placed indoors, or pointed the wrong way, and it would be arbitrary and capricious to force *over-the-air* antennas to overcome these severe obstacles to successful reception. It would also violate one of the most fundamental assumptions of the Commission's entire DTV planning process, leaving broadcasters in the position of having built a system to Commission specifications that the Commission would now condemn as inadequate (because it is not designed for indoor or low-quality outdoor antennas).

- **Signal strength measurements**: The Commission's existing procedures for measuring signal strength at individual locations will work well, with minor modifications, for measuring digital signal strength.

- **Objective vs. subjective test for which households are "unserved"**: If a location has objective signal strength above the minimums specified for digital (*e.g.*, 41 dBu for UHF), field tests show it is overwhelmingly likely that a high-quality picture can be received at that location. The Commission's existing DTV minimum signal strengths are therefore an excellent metric for determining which households are "served" by digital signals. Use of a subjective standard would be a disaster, just as it was when the DBS industry (illegally) implemented such a standard a few years ago. Application of such a standard would be arbitrary and capricious.

- **Development of a predictive model**: When given the ultimate test -- being compared to the results of actual measurements -- the Longley-Rice model does exceptionally well at predicting whether or not particular locations will receive a signal above the DTV minimums. Longley-Rice makes correct predictions 95% of the time about digital signals, and the model's errors are divided roughly evenly between over- and underpredictions. Thus, if and when a predictive model is needed for over-the-air digital signals, Longley-Rice is the right choice.

In the short run, however, there are very serious practical problems with using the results of a digital Longley-Rice model as a basis for signing up subscribers. First, certain stations can be evaluated starting in April 2006; many others not until July 2007; and still others at a variety of different (currently unknown) dates thereafter. Keeping track of all of this in a predictive model would be daunting, to say the least. Second, the channels on which particular stations will broadcast in digital are still -- and will remain for some time -- in flux. Third, the Commission would need to design a hybrid digital/analog predictive model to take into account those stations (such as translators) that are not expected to broadcast in digital until some future date. Finally, if this complex, changing, hybrid digital/analog Longley-Rice model were being run internally by EchoStar, still another layer of concern would arise, since a federal judge found that EchoStar illegally manipulated the *analog* ILLR model in three different ways (behind the scenes) to sign up ineligible subscribers. *See CBS Broadcasting Inc.*, 265 F. Supp. 2d 1237, 1248-50 (S.D. Fla. 2003).

Because of these many concerns, implementing a "digital ILLR" model in the near term is fraught with difficulties. To the extent that the DBS companies do not offer digital local-to-local in every market at the end of the transition, however, there may be a need then for a digital predictive model to be applied to individual households. The Commission should endorse Longley-Rice for that long-term purpose.

Variations in DTV receivers. Since one can obtain a high-quality picture from an above-minimum strength signal almost all the time using even early-generation DTV receivers, differences in quality among receivers are not material to an objective signal strength test. In any event, the most recent round of receivers -- the fifth generation -- does vastly better than older receivers at achieving reception in difficult environments, such as multipath. As these (and future, still further-improved generations of) receiver chips are incorporated into set-top boxes, the already strong connection between signal strength and picture quality will become even more robust.

Additional clutter factor. Longley-Rice already reflects environmental "clutter" -- trees and buildings -- because it was built in part based on real-world measurements, which can't help but reflect the effects of clutter. In any event, since the Longley-Rice model *without* a special clutter factor is already highly accurate -- and well-balanced between overpredictions and underpredictions -- putting a thumb on one side of the scale with a new clutter factor would make the model *less* accurate.

The National Association of Broadcasters ("NAB") hereby files its comments in response to the Notice of Inquiry ("Notice") released by the Commission on May 3, 2005, in the above-referenced proceeding.[1/]

I. THE SATELLITE HOME VIEWER ACT, THE SHVIA, AND THE SHVERA

The Commission's Notice of Inquiry asks for comment on several specific issues relating to the measurement and prediction of over-the-air digital television signals. Because it is important to appreciate both the broader policy issues behind these issues and the specific statutory context, we begin with a brief history of the key features of the Satellite Home Viewer Extension and Reauthorization Act of 2004 ("SHVERA") and its predecessors.

A. SHVA (1988, 1994): Distant Signal Delivery to "Unserved" Households -- Those Unable To Receive a Grade B Signal From An Over-the-Air Network Station with a Rooftop Antenna

Section 119 of the Copyright Act, first enacted as part of the Satellite Home Viewer Act in 1988 and renewed in 1994, allows satellite companies to provide a lifeline service to the small number of households that cannot receive ABC, CBS, Fox, and NBC stations over the air -- *i.e.*, "unserved households." 17 U.S.C. § 119. The key test for whether a household is "unserved" is whether it can receive an analog signal of "Grade B intensity." *Id.*, § 119(d)(10). Despite claims by DBS companies that "Grade B intensity" could be determined by asking viewers if they are satisfied with their TV reception, the courts -- and the Commission -- have uniformly and correctly concluded that Grade B intensity is an *objective* measure of analog signal strength.

1/ NAB is a nonprofit, incorporated association of radio and television broadcast stations that serves and represents the American broadcast industry.

Congress has revised the original SHVA in 1994, 1999, and 2004. In each instance, Congress has confirmed that, to evaluate whether a household can receive a Grade B intensity analog signal, the Act assumes use of a *rooftop* -- not an indoor -- antenna. In addition, as the Commission found in 2000, the rooftop antenna must be properly oriented to obtain the strongest signal from the station in question. *In Re Technical Standards for Determining Eligibility for Satellite-Delivered Network Signals Under the Satellite Home Viewer Improvement Act*, ET Dkt. No. 00-90, ¶¶ 33-36 (released Nov. 29, 2000).

B. **SHVIA (1999) Permits DBS Firms to Deliver Distant Signals Based on Either a *Measurement* or a *Prediction* that the <u>Household Cannot Receive a Grade B Intensity Analog Signal</u>**

In 1999, in revising the distant signal license as part of the Satellite Home Viewer Improvement Act ("SHVIA"), Congress decided that a satellite carrier could show that a household was "unserved" over-the-air by an analog station *either* through a field test *or* through a prediction made by the Individual Location Longley-Rice ("ILLR") model. 17 U.S.C. § 119(a)(2)(B)(ii). Last year, in the Satellite Home Viewer Extension and Renewal Act ("SHVERA"), Congress extended the basic "Grade B intensity" standard for reception of distant analog network affiliate signals, including eligibility based either on a field measurement or on an ILLR prediction.

C. **SHVERA Confirms that DBS Firms Can Deliver Distant *Digital* Signals Based on an ILLR Prediction that <u>the Household Cannot Receive a Grade B Intensity *Analog* Signal</u>**

In the 2004 SHVERA, Congress endorsed (for the next five years) the principle that a household unable to receive a Grade B analog signal from any station affiliated with the relevant network may receive *either* a distant **analog** *or* a distant **digital** signal of an affiliate of that network. 47 U.S.C. § 339(a)(2)(D)(i)(I), (II). Thus, under current law, a household that is unable to receive a Grade B signal from (say) an NBC station is eligible to receive a distant *digital* NBC station signal. In other words, satellite companies can *already* rely on the ILLR model -- the *analog* ILLR model -- to determine whether it is lawful to deliver a distant digital signal to a household.

D. SHVERA Authorizes DBS Firms to Deliver Distant Digital Signals Based on *Site Tests* of Certain Over-the-Air Digital Signals, But Does Not Authorize DBS Firms to Do So Based on *Predictions* About Over-the-Air Digital Signals

In the SHVERA, Congress for the first time modified the distant signal statutory scheme to permit transmission of distant signals based on the unavailability of an over-the-air *digital* signal. 47 U.S.C. § 339(a)(2)(D)(i)(III). This new method of qualifying subscribers to receive distant signals will not go into effect until April 30, 2006, and even then it will apply only to a limited number of stations in the top 100 markets. (Other stations will be subject to this new rule in 2007 or later.) If a satellite company wishes to deliver distant digital signals to a subscriber based on this new criterion, it must conduct a site measurement to establish that fact. 47 U.S.C. § 339(a)(2)(D)(vi) ("Signal Testing for Digital Signals").[2/]

Whether a satellite household should be considered eligible to receive a distant digital ABC, CBS, Fox, or NBC signal based on a *prediction* that it cannot receive an over-the-air digital signal is a separate issue. While the Senate Commerce Committee approved a bill in 2004 authorizing creation of digital predictive model,[3/] Congress as a whole ultimately rejected

[2/] As discussed below, distant digital signals cannot be offered to new subscribers once the DBS company offers digital local-to-local service to the those subscribers. 47 U.S.C. § 339(a)(2)(D)(iv). In addition, if *analog* local-to-local is available to the household, the subscriber must purchase that service in order to receive a distant digital signal, even if the household has been tested and found not to receive a digital signal over the air. 47 U.S.C. § 339(a)(2)(D)(iii)(III) (analog buy-through provision).

[3/] Senate Committee on Commerce, Science, and Transportation, *Satellite Home Viewer Extension And Rural Consumer Access To Digital Television Act Of 2004*, S. Rep. No. 108-427, that approach. As enacted, the SHVERA allows a satellite carrier to sign up a subscriber claiming unavailability of an over-the-air digital signal *only* based on the results of an actual field measurement. 47 U.S.C. §§ 339(a)(2)(D)(i)(III), 339(a)(2)(D)(vi). It would take an act of Congress for a DBS firm to be able to rely on a digital predictive model to sign up a subscriber for a distant digital signal.

II. THE IMPORTANCE OF LOCALISM AND THE NEED TO PROMOTE LOCAL-TO-LOCAL SERVICE, RATHER THAN DISTANT SIGNALS

As just discussed, in the SHVERA Congress elected to take a cautious approach in authorizing DBS companies to carry digital signals of distant ABC, CBS, Fox, and NBC stations based on claims that subscribers cannot receive digital signals from nearby over-the-air stations. That decision fits squarely into the philosophy that both Congress and the Commission have followed for many decades: that the public interest is served when multichannel video programming distributors carry *local* television stations, but can easily be harmed when they import *distant* TV stations.

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at 8-9 (2004) ("Thus, the Commission would (1) determine the appropriate signal standard for determining eligibility for distant digital signals; (2) develop a predictive model for presumptively determining the ability of individual locations to receive digital signals in accordance with the signal standard . . . .").

A. The Commission's Recommendations Should Reflect the Importance of Preserving Localism and Free, Over-the-Air Broadcasting

1. Congress and the Commission Have Consistently Recognized the Importance of Protecting Free, Over-the-Air, Local Television Broadcasting

Unlike many other countries that offer only national television channels, the United States has succeeded in creating a rich mix of *local* television outlets through which more than 200 communities can have their own local voices. But as the House Judiciary Committee observed last year, "[t]he availability of local programming is largely dependent on the continued health of network affiliates, who use revenue from the sale of advertising, the rates for which depend on audience size, to produce local content." Committee on the Judiciary, *Satellite Home Viewer Extension and Reauthorization Act of 2004*, H.R. Rep. No. 108-660, at 7-8 n.4 (2004).

Although cable, satellite, and other technologies offer alternative ways to obtain television programming, at least 20 million American TV households still rely on broadcast stations -- principally ABC, CBS, Fox, and NBC stations -- as their exclusive source of television programming.[4/] In addition, tens of millions of other households rely on over-the-air reception for some of the televisions in their homes.[5/]

The 1988 SHVA and its successors (including the 2004 SHVERA) implement a longstanding communications policy of ensuring that these free, local, over-the-air outlets will

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4/ *See* Reply Comments of National Association of Broadcasters, *In Re Over-the-Air Broadcast Television Viewers*, MB Docket No. 04-210, at 3 (Sept. 7, 2004) ("NAB OTA Reply Comments"); *see Annual Assessment of the Status of Competition in the Market for the Delivery of Video Programming*, MB Docket No. 04-227, at 52 (2005) (citing conservative estimate of 16 million households).

5/ NAB OTA Reply Comments, MB Docket No. 04-210, at 9.

continue to provide high-quality programming in more than 200 local markets, large and small, around the United States. In particular, the "unserved household" limitation of SHVA and its successors is designed to protect local network affiliates from importation of duplicative network programming, such as delivery of the New York City ABC station to viewers in Omaha. In considering possible recommendations about how to implement the latest revision of the SHVA, the Commission should keep these overarching policy considerations in mind.

2. Unlike Delivery of Distant Signals, Local-to-Local is a Winning Formula for Satellite Carriers, Broadcasters, and Consumers Alike

Unlike importation of distant network affiliates, delivery of local stations is good for consumers, for broadcasters, and for DBS firms alike. For that reason, Congress and the Commission have consistently sought to foster local-to-local service and to minimize delivery of distant signals.

From a policy perspective, there is no benefit -- and there are many drawbacks -- to satellite delivery of distant, as opposed to local, network stations. Unlike local stations, distant stations do not provide viewers with their *own* local news, weather, emergency, and public service programming. Nor does viewership of distant stations provide any financial benefit to *local* stations to help fund their free, over-the-air service. To the contrary, distant signals, when delivered to any household that can receive local over-the-air stations, simply siphon off audiences and diminish the revenues that would otherwise go to support free, over-the-air programming.

Until 1999, satellite carriers, unlike cable systems, lacked a copyright compulsory license authorizing them to carry local TV stations. The 1999 SHVIA created, for the first time, such a compulsory license. And thanks to the ability to offer local stations, DirecTV and EchoStar have enjoyed growth rates since SHVIA's enactment that any industry would envy.